Spring length = 20.0 cm with no mass
= 39.0 cm with 500g suspended.

What is the spring constant?

k= F/x = (0.500~~kg~~ x 9.80N/~~kg~~)/0.19m
4.9/0.19=25.7895 = 25.8N/m

What is the force on the mass if you pull the mass down 2.0 cm (more) and let go (start the time when it reaches equilibrium)
F_{net}= kx = 25.7895x0.02=0.5158 N = 0.52N

What will the x-t, v-t, a-t, and F-t graphs look like?

A = x_o = 0.020m
T= 2pi root(m/k)
T = 2x3.14159xSqrt(0.5/25.7895)=
0.874869029230033 s
$\omega = 2\pi f$ = 2x3.14159x(1/0.874869029230033)=
7.181852128803542 = 7.2 Rad/s or 7.2 s^{-1}
assume radians for this stuff

2pi Radians = 360º

$x = x_o \sin\omega t = 0.020\text{m} \sin(7.2\text{s}^{-1}\, t)$

$v = v_o \cos\omega t = 0.14\text{ms}^{-1} \cos(7.2\text{s}^{-1}\, t)$

$v_o = x_o\omega$

Ok?

$a = -a_o \sin\omega t = -1.0 m/s^2 \sin(7.2 s^{-1} t)$
$a_o = x_o \omega^2 = 0.02 x (7.181852128803542)$
$x(7.181852128803542) = 1.03158$

$F = ma = 0.50 N \sin(7.2 s^{-1} t)$

all the graphs are sinusoidal with period 0.87s and amplitudes as specified in the equations above.

energy
$E_{elastic} = 1/2\ kx^2$ derived from the area under the f-x graph

another way to find the max velocity is from conservation of energy.

eg. if in the previous question, the max extension is 2.0 cm and the spring constant is 26 N/m, what is the max elastic energy? the max kinetic energy? calculate max speed using the kinetic energy. sketch the energy graph - superimpose the kinetic energy and the elastic energy.

a) vs x
b) vs t

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eg. if in the previous question, the max extension is 2.0 cm and the spring constant is 26 N/m, what is the max elastic energy?

$E=1/2\ kx^2 = 0.5x26x(0.02)x(0.02)=0.0052$ J

the max kinetic energy?

elastic energy transforms into kinetic energy, so

E_k max = 0.0052 J when x = 0 equilibrium

calculate max speed using the kinetic energy.

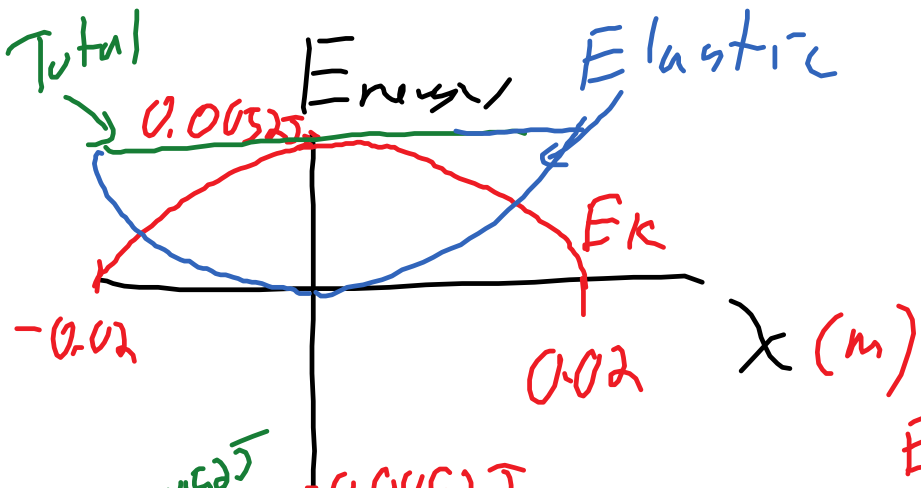
$1/2mv^2 = 0.0052$J

v = Sqrt(2x0.0052/0.5)=0.14422205101856

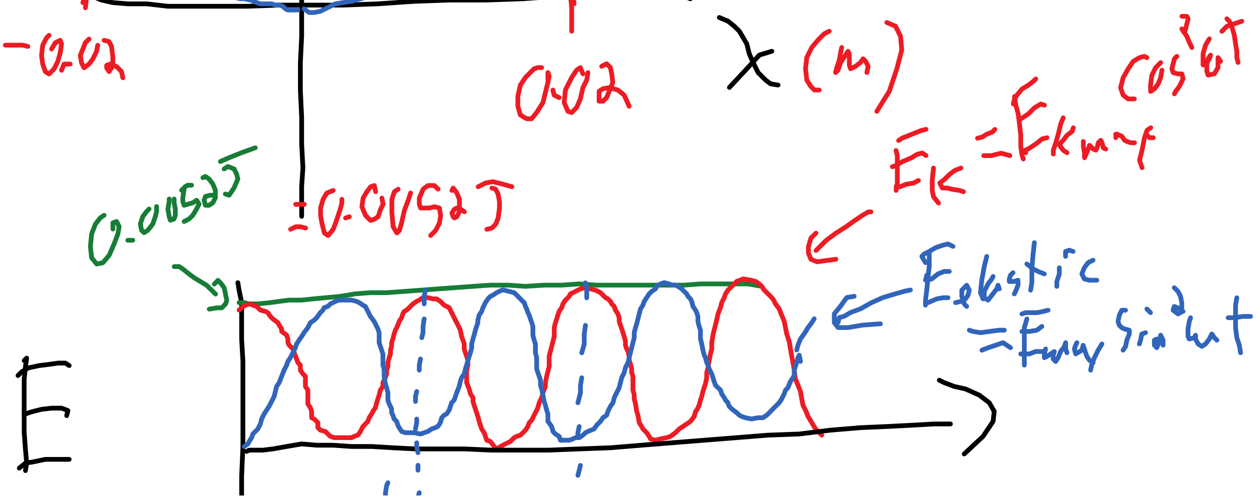
v= 0.14m/s

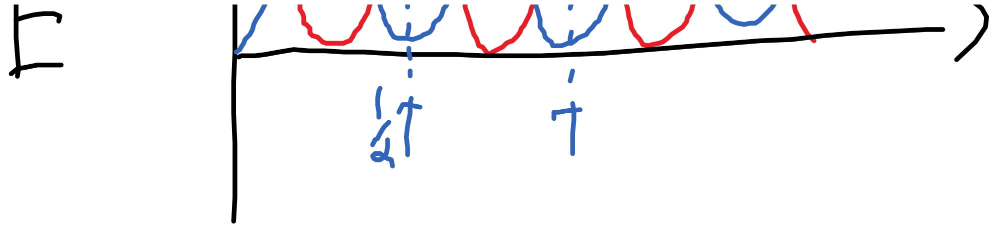
sketch the energy graph - superimpose the kinetic energy and the elastic energy.

a) vs x

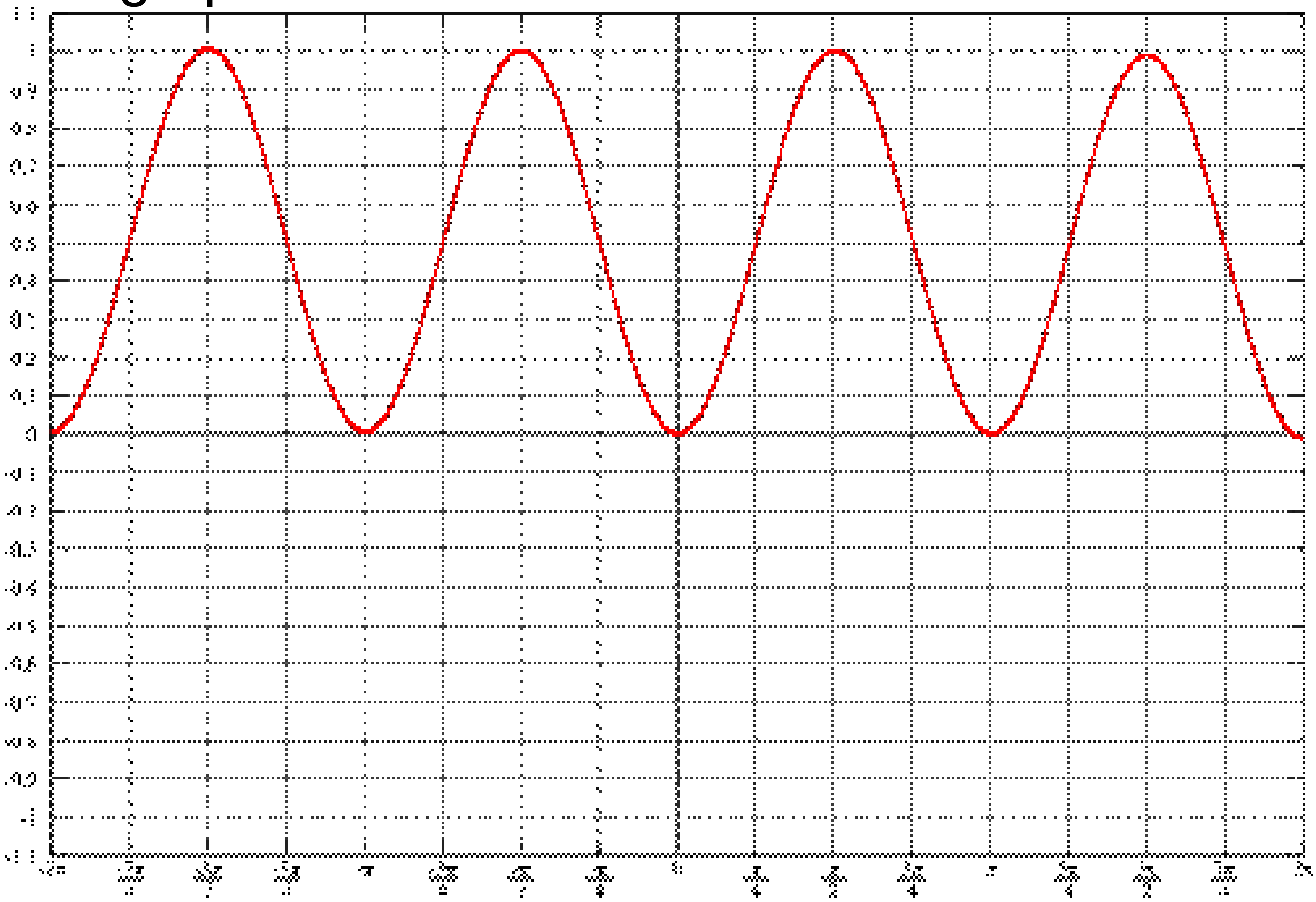


a) vs t





$\sin^2$ graph



$\sin^2$ with sin